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ABSTRACT

As primary agents involved in reform and innovation in preparation programs, teacher educators require ongoing evaluation of the impacts of change. This paper reports a study to determine preservice teachers' concerns as they progressed through a traditional teacher preparation program and changes in their concerns that may have been attributed to coursework and field experiences. Concerns of undergraduate preservice secondary science teachers seeking certification in Biology, Physics, Chemistry, Earth Science and General Science were measured using the Preservice Stages of Concern Questionnaire in each of the academic years of preparation and determined the progression of concerns through those 4 years of preparation. The results of the investigation indicated that during the freshman and sophomore years, the overall shape of the profiles were not changed. The primary concerns remained informational in nature. During the junior year, the profiles became more student centered, with concerns shifting to consequence, collaboration, and refocusing. The consequence, collaboration, and refocusing concerns rose again during student teaching, indicating that the preservice teacher becomes less concerned with their knowledge and ability to teach and becomes concerned with their impact upon students. The study concludes that these findings differ from other studies which may depend on the different instruments utilized for the study. To study the problem further, a longitudinal study with improved instrumentation, additional sites, and a larger sample size is indicated. (Contains 18 references.) (MDH)

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THE EVOLUTION OF PRESERVICE SCIENCE TEACHERS' CONCERNS ABOUT TEACHING

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THE EVOLUTION OF PRESERVICE SCIENCE TEACHERS' CONCERNS ABOUT TEACHING

INTRODUCTION

As primary agents involved in reform and innovation in preparation programs, teacher educators require ongoing evaluation of the impacts of change. One dimension of impact, identified by Frances Fuller in the late sixties (Fuller, 1969), is that of change in preservice teachers' concerns as they progress through their training and early experiences. Underlying her investigations was the recognition that preservice teachers frequently regarded their education coursework as irrelevant and of minimal value. Fuller suggested that this could be due to students' lack of motivation because their concerns were not addressed in coursework. Examination of preservice teachers' concerns led Fuller to a basic construct of a developmental progression from self to task to impact concerns (Fuller, 1969).

Roberts and Chastko (1990) reported on some aspects of a preservice science methods course. The authors asserted that such courses are important arenas in which to conduct research on the development of science teacher thinking. The authors pointed out that science teacher thinking is conspicuously missing from the third Handbook of Research on Teaching, (White and Tisher, 1986) and the four most recent annual reviews of research in Science Education by Shymansky and Kyle (1988), Gallagher (1987), Lawson et al. (1986), and Holliday et al. (1985). However, Lederman and Gess-Newsome (1991) reported that teachers' thinking has been in the education literature during the last decade. The following studies have provided insight into how teachers plan for instruction and upon what bases instructional decisions are made; Berliner & Rosenshine (1987) and Clark & Peterson (1986). However, the need for longitudinal studies which investigate the total professional development from prior to student teaching to after student teaching was well documented by Clark and Peterson (1986).

Roberts and Chastko proposed an analytic framework the "Science Teacher Thinking Model" (STTF), to assist students to think reflectively about science teaching episodes. The STTF framework included: subject matter + teaching strategy --> objectives <--> student response. Subject

matter was defined as "what science is being taught". Teaching strategy was defined as "what do I do in the classroom". Objectives were defined as "what is supposed to happen to students". Student response was defined as "how do I know what is happening to students".

The preservice teachers concerns model addressed the same components in a different manner. The subject matter component is homologous to the "self" concern as defined by Fuller (1969) and the "information" concern as defined by Hall, George, & Rutherford (1986). See Figure Four for definitions. The "teaching strategy" component is homologous to the "task" concern as defined by Fuller (1969) and the "personal" and "management" levels of concerns as defined by Hall, George, & Rutherford (1986). The "objectives" and "student response" components are homologous to the "impact" concerns as defined by Fuller (1969) and the "consequence" level of concern as defined by Hall, George, & Rutherford (1986). The reflective thinking which resulted from the use of the STTF model may indicate the "collaboration" and "refocusing" levels of concerns as defined by Hall, George, & Rutherford (1986) and "impact" concerns as defined by Fuller (1969). The motivation of students to think reflectively based upon their current concerns may have applicability in the interpretation of the reflection, refraction or absorption as approaches to learning and teaching about teaching as suggested by Roberts and Chastko (1990).

Lederman and Gess-Newsome (1991) found preservice teachers' concerns were shifted during the time between a microteaching course and student teaching. The study was conducted by using an open-ended questionnaire. The results indicated that although there was no formal intervention during this time period, the preservice teachers' reflections and anticipation caused the noted change. These results were interpreted by the authors as a type of metamorphosis rather than evolution as suggested by the earlier literature. Perhaps this metamorphosis was the result of altered concerns (Fuller, 1969 and others) and reflective thinking as defined by Roberts and Chastko (1990).

PURPOSE

This investigation was designed to determine preservice teachers' concerns as they progressed through a traditional teacher preparation

program. The changes that may have been attributed to coursework and field experiences were also investigated. Lastly, insight into the metamorphosis, adaptation, or evolution of concerns and the possible use of concerns to explain the absorption, refraction, or reflection of thinking exhibited by users of the Science Teacher Thinking Model was of interest.

METHODOLOGY

This investigation measured the concerns of undergraduate preservice science teachers in each of the academic years of preparation and determined the progression of concerns through those four years as a result of a traditional teacher preparation program. An assumption in this research was that the seniors of today had the same concerns when they were freshmen as do the freshman of today. This assumption allowed the use of a compressed time frame (one year) for longitudinally interpreted data.

This research was conducted at a traditional four year university. All secondary science teacher certification programs typically required 46 semester hours in the science content area, 48 semester hours of general education, and 24 semester hours of professional education courses prior to 16 weeks of student teaching.

The subjects in this investigation were secondary science education majors in a small rural university seeking certification in Biology, Physics, Chemistry, Earth Science, and General Science. They were enrolled in courses in the typical course sequence for the freshman through senior year. See Table One.

Insert Table One about here.

This research was conducted through a series of testings. Declared science education students and student teachers were tested in September and December as well as January and May. Juniors, in a science methods class, were tested in September and December. The education courses selected for these testings were appropriate for the level of students and admission was determined by advisement. Data from the freshman, sophomore and seniors (student teachers) were combined for each semester.

Several instruments for assessing concerns have been devised. One of the most widely used has been the Stages of Concern Questionnaire (SoCQ) developed by the Concerns Based Adoption Model Project at the Research and Development Center for Teacher Education, University of Texas at Austin (Hall, George, & Rutherford, 1986). Used as a means of tailoring assistance and training efforts for inservice teachers, it is easily administered and scored, and produces detailed data. The SoCQ has also found some use in research studies of preservice teachers (Barnes & Huling-Austin, 1984; Malone, 1984).

This history led to a pilot study by the author and a colleague in 1986-87. The SoCQ was administered to preservice teachers from a traditional, four year program and a fifth-year, post-baccalaureate program at the beginning and at the end of their student teaching semester. The results of this pilot study (O'Sullivan & Zielinski, 1988), and the reservations expressed in the earlier studies cited (Barnes & Huling-Austin, 1984; Malone 1984) and in related studies (Adams, Hutchinson, & Martray, 1980; Cooperstein, 1981; Reeves & Kazelskis, 1985) prompted a revision of the instrument and an in-depth examination of a slightly modified version of the SoCQ, the Preservice Stages of Concern Questionnaire (PSSoCQ) as an instrument for assessing the concerns of preservice teachers.

The Preservice Stages of Concern Questionnaire (PSSoCQ) was validated by the author and colleague. The revised instrument was demonstrated to contain content and construct validity, test-retest reliability, concurrent reliability with stages of the SoCQ, the ability to discriminate differences in concerns between two samples, and detect changes in concerns over time (O'Sullivan & Zielinski, 1989). Local norms were developed and compared without finding any large differences among three groups. The PSSoCQ was found to be a valid, reliable instrument capable of detecting changes in preservice teachers' concerns over time (O'Sullivan & Zielinski, 1989; Zielinski, 1990).

The outcomes of this project could have impact on the education of preservice teachers. The results from this study and investigations like it may include better sequencing of courses, content revision, field experience recommendations, and ultimately prescriptive interventions during field experiences. Additionally, it could help to interpret the results

of Lederman and Gess-Newsome (1991) and Roberts and Chastko (1990). A valid reliable instrument with guidelines for interpretation would alleviate some of the problems associated with data acquisition and analyses of open-ended questionnaires. The outcomes of this project were measured by achieving the following objectives stated as questions for research purposes:

RQ1. What were the concerns of preservice science teachers in their freshman, sophomore, junior and senior year of teacher preparation?

RQ2. Were preservice science teachers' concerns significantly changed or resolved through coursework or field experiences during the above stated academic years?

RQ3. Do the hypothesized changes in concerns represent metamorphoses, adaptation, or evolution?

Mean scores were calculated from the raw data and converted to percentiles. Concerns profiles were developed for each of the groups using the PSSoCQ Quick Score sheet, (Zielinski, 1989). Concerns profiles were analyzed for the changes of the students' concerns between the pre-and posts using a peak stage interpretation.

RESULTS

The concerns of preservice science teachers are plotted on Figures One and Two. Figure One represents the pretest data for each of the four years and Figure Two presents the posttest data. The data for each of the years is presented in Table Two. These data were used in the development of the concerns profiles, Figures One and Two and to depict the rate of change in Figure Three. For the purposes of this investigation a percentile point change of ten will be considered educationally important.

Insert Table Two about here

Figures One and Two indicate that freshman began with peak concerns in the informational area and these were not resolved during the first year. However inspection of Table Two indicates that awareness concerns dropped 10 percentile points, personal concerns were raised 12

percentile points, management concerns were raised 10 percentile points and collaboration concerns raised 12 percentile points. Sophomores peak concerns began at the informational level and likewise were not resolved during the sophomore year. there were changes in the profiles. Awareness concerns dropped 15 percentile points, and refocusing increased by 13. Science methods students, who have the first extended field experience, began the semester with peak concerns at the consequence level with similar elevated concerns at the informational, collaboration, and refocusing levels. At the end of the science methods course and the early field experience, the informational concerns were lowered by 16 percentile points. However, the consequence and collaboration concerns remained high with refocusing concerns becoming the peak area of concern. Important changes during this time were awareness concerns -16 percentile points and informational concerns by +12. Science student teachers began the semester with the peak at the refocusing stage of concern. A second peak was found at the informational stage. Fifteen weeks later, at the end of student teaching, all concerns except awareness, were elevated. Substantial increases were found in personal +23, management +16, consequence and collaboration +38, and refusing +26.

Insert Figure One about here

Insert Figure Two about here

Discussion

RQ1. What were the concerns of preservice science teachers in their freshman, sophomore, junior and senior year of teacher preparation?

RQ2. Were preservice science teachers' concerns significantly changed or resolved through coursework or field experiences during the above stated academic years?

The results of this investigation indicated that although there were important changes of concerns during the freshman and sophomore years, the overall shape of the profiles were not changed. The primary concerns

remained informational in nature. Yeany and Padilla (1986) suggested the microteaching course and student teacher education programs continue to provide the primary focus for teacher education programs as a whole. Perhaps it should be so. During the Junior year, which is associated with an early field experience and/or microteaching courses, the profiles in this investigation began to change dramatically. The profiles became more student centered, the peak concerns shifted to consequence, collaboration, and refocusing. These impact level concerns are reflected in the objectives and student response cells of the STTF model and may indicate that a preservice teacher is not ready to become reflective until they have been confronted with a teaching situation. A regression towards student centered concerns appeared between the methods class and student teaching. Because the preservice teacher is about to student teach concerns at the personal and information level are again appropriate because they are being confronted with a totally new teaching situation. The preservice teacher is concerned about their ability to teach students rather than peers and whether or not they have acquired sufficient information to be successful in their new teaching setting. The consequence, collaboration, and refocusing concerns rose again during student teaching to become the peaks, indicating that the preservice teacher became less concerned with their knowledge and ability to teach and were becoming concerned with their impact upon students.

Roberts and Chastko (1990) remarked that reflection about teaching is a capability requiring both appropriate knowledge and appropriate attitude. The concerns of a student teacher may mirror their attitudes. The student teachers who reduced their knowledge and personal concerns and increased their concerns about collaboration may be indicating reflection and a willingness to share their reflections about their teaching with others.

Roberts and Chastko further remarked, "One wonders if there is some sort of predisposition to reflect (or not to reflect), such that no matter what one does-some students who enroll in teacher education will develop the capability to only a very limited degree." Perhaps the "predisposition to reflect" is actually the level of concern which is present in the student. A methods student or student teacher who is primarily concerned about whether or not they are knowledgeable enough to teach can hardly reflect

upon the effects of their lessons upon the students. The three refractory styles described by Roberts and Chastko; "Everything-was fine," "who needs this," and "haven't-you-forgotten-something," would indicate low levels of concern at all stages. This low level of concern may also indicate they believed the reflection was not important or meeting their immediate needs (concerns).

RQ3. Do the observed changes in concerns represent metamorphoses, adaptation, or evolution?

A decrease of student centered concerns between the methods course and student teaching is in contrast to the apparent increase of these same concerns reported by Lederman and Gess-Newsome (1991). Perhaps the fact that the students in this investigation were working with secondary school students prior to student teaching and the participants in the Lederman and Gess-Newsome investigation were teaching peers, is responsible for the discrepancy. Alternatively, the differences in instrumentation may be important. Both investigations used a model which has been in the literature for approximately 20 years, however, this study used an instrument which forced choices upon the respondent rather than an open-ended questionnaire. Both studies painstakingly validated the instruments, however, the seemingly discrepant results may indicate a need for further research to refine these instruments and their interpretations. The statements of concern presented by Lederman and Gess-Newsome may provide insight for the refinement of the PSSoCQ to more accurately indicate the concerns of preservice teachers.

Lederman and Gess-Newsome's question "Can a preservice teacher have real concerns prior to being in a situation which actually contains real students?" is a good one. It is important to note that no significant shifts in the concerns profiles for either study were found until the students were actively involved with teaching. Either through the teaching of peers, or as in this study, the early field experience with the secondary school students. This finding supports the scheduling of field or teaching experiences early in the teacher preparation program. Early field experiences in the preservice teaching careers of candidates may

accelerate the development of student centered concerns or the ability to reflect upon ones own teaching.

The underlying assumption of this investigation, e.g. that the seniors of today had the same concerns when freshman as the freshman of today, may threaten its' validity. Perhaps history has tainted the sample or the assumption is wrong. However, the results are still promising for detecting what preservice teachers are concerned about at different temporal points of their development and interpreting absorption, refraction, or reflection in combination with the STTF analytic framework. A truly longitudinal study with improved instrumentation, additional sites, and a larger sample size is indicated.

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Table 1
Pretest demographics of the preservice sample.

			Major*				
Group	M	F	Biol.	Chem.	Phy.	E. Sci	Gen. Sci.
Fresh.	12	3	4	3	1	5	2
Soph.	12	7	5	2	5	5	4
Sci. meth	13	11	9	7	6	4	5
SST	14	9	10	5	6	6	1

* Majors total exceeds subjects due to double majors.

Table 2
Pretest-posttest percentile change by group and stage

		Stages*						
Group	N	0	1	2	3	4	5	6
Fr. pre	15	70	86	55	49	65	46	66
post	8	60	83	67	59	72	58	73
diff.		-10	-3	12	10	7	12	7
So. pre	19	71	81	58	54	60	56	65
post	19	56	81	66	59	69	65	78
diff.		-15	0	8	5	9	9	13
SM pre	24	63	83	75	68	85	83	86
post	23	47	71	71	65	92	90	95
diff.		-16	-12	-4	-3	7	7	9
SST pre	23	42	60	42	38	54	54	73
post	17	42	65	65	54	92	92	99
diff.		0	5	23	16	38	38	26

* Mortality during the freshman year and student teaching experience was primarily due to absences on the day of posttesting.

Figure 1
Secondary preservice science teachers pretest, 1990/91

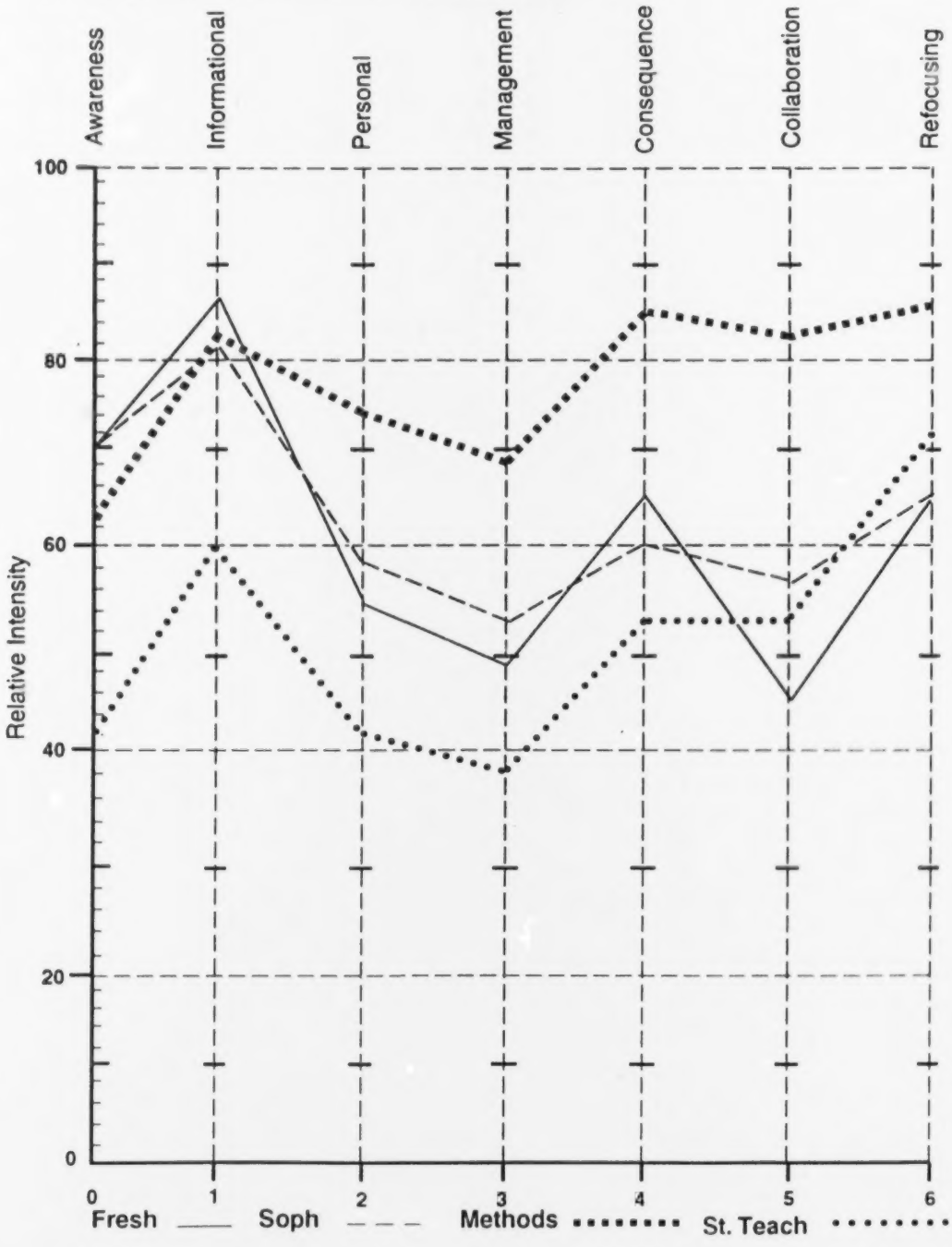

Figure 2
Secondary preservice science teachers posttest, 1990/91

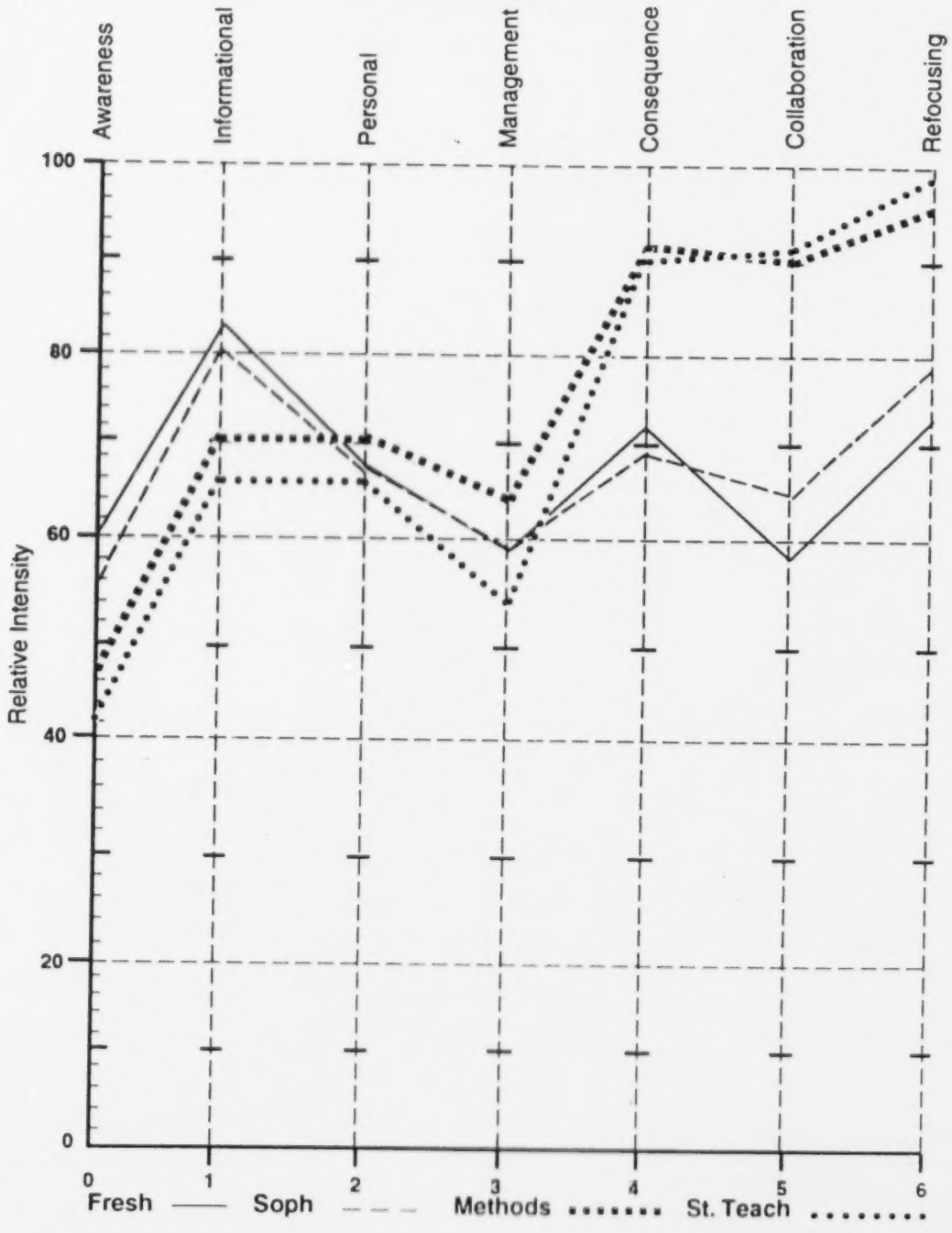

Figure 3
Percentile change post-pre by group and stage

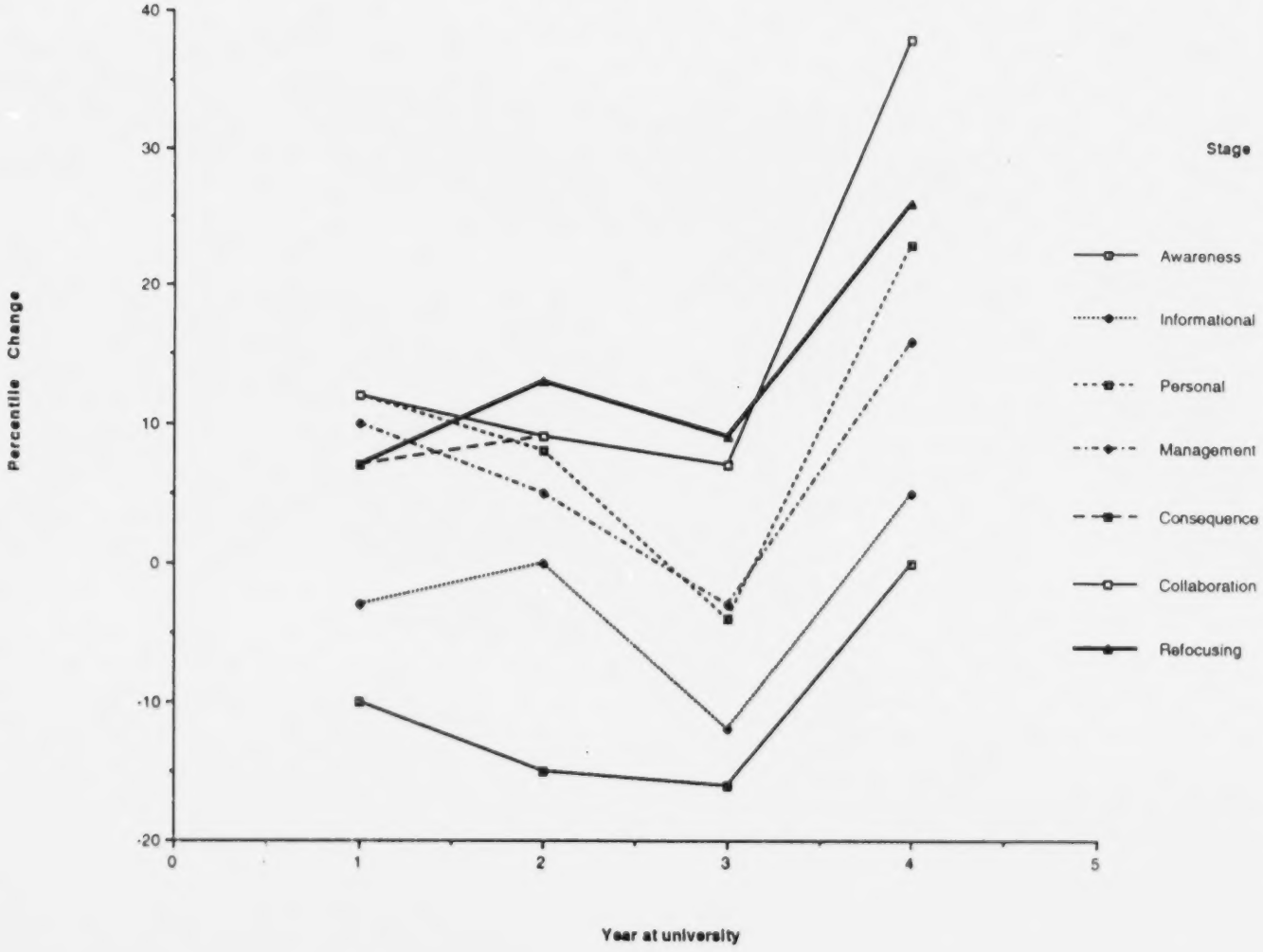

Figure 4
Stages of Concern About Teaching[1]

0 AWARENESS: Little concern about or involvement with teaching is indicated.

1 INFORMATIONAL: A general awareness of teaching and interest in learning more detail about it is indicated. The person seems to be unworried about herself/himself in relation to the teaching. She/he is interested in substantive aspects of teaching in a selfless manner such as general characteristics, effects, and requirements.

2 PERSONAL: Individual is uncertain about the demands of teaching, Her/his inadequacy to meet those demands, and her/his role with teaching. This includes analysis of her/his role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.

3 MANAGEMENT: Attention is focused on the process and tasks of teaching and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost.

4 CONSEQUENCE: Attention focuses on impact of teaching on students in her/his immediate sphere of influence. The focus is on relevance of teaching for students, evaluation of student outcomes, including performance and competencies, and changes needed to increase student outcomes.

5 COLLABORATION: The focus is on coordination and cooperation with others regarding use teaching.

6 REFOCUSING: The focus is on exploration of more universal benefits from teaching, including the possibility of major changes or replacement with a more powerful alternative. The individual has definite ideas about alternatives to the proposed or existing form of teaching.

[1] Adapted from Measuring stages of concern about the innovation: A Manual for Use of the SoC Questionnaire. Hall, G.; George, A.; & Rutherford, W. The Research and Development Center for Teacher Education, The University of Texas at Austin, 1979.